MUCH NEEDED REVISIONARY STUDIES OF NEOTROPICAL GRASSHOPPERS AS SEEN FROM CURRENT WORK ON THE SUBFAMILY LEPTYSMINAE

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Several, years ago I attempted to prepare a faunistic report, with a sizable collection of grasshoppers available from the vicinity of Puerto Lopez in the llanos of Colombia. There was no problem distinguishing the species present, but to apply a valid name to them appeared to be a hopeless task. Recently there have been a few excellent revisionary studies on groups of Neotropical grasshoppers, but the great majority of them have not been critically studied, and it is my impression that many of the groups remain in a state of confusion. This is largely due to the lack of published information on the identification of the older types in Europe and the indiscriminant description of species by Lawrence Bruner in the early 1900's.

I subsequently began a revisionary study of the tribe Leptysmini both because the need seemed great and because the tribe appeared to have many useful and interesting morphological characters. Based on this research I will attempt to outline some recommendations on what appear to be the most pressing needs of Neotropical grasshopper systematics for the inmediate future.

The tribe Leptysmini includes some forty species and subspecies, and it is most commonly represented by the genera *Leptysma* and *Stenacris*. This tribe is closely related to and probably derived from the other major tribe of the subfamily, the Tetrataeniini, which is commonly represented by the genera *Cornops* and *Inusia*. The subfamily Leptysminae is peculiar to the American tropics except for a few species that reach the north temperate zone and a few that reach central Argentina.

To begin this study several thousand specimens were assembled through loans from other museums, especially the Museum of Zoology of the University of Michigan, together with the large collection of the Academy of Natural Sciences of Philadelphia. This assemblage of specimens included examples from virtually all of the geographical areas from where the tribe has been reported. However, there are still extensive areas in the Amazon Basin and elsewhere which remain to be explored. After a preliminary survey of the tribe, I undertook a revision of the genus *Cylindrotettix*, wich included 13 species and subspecies. This study was completed in early 1975 and published later that year. This has been followed by a study of all of the remaining genera and species of the tribe, and it would have been completed by now were it not for an unfortunate motor accident that befell me.

The most challenging part of a systematic study of a large collection is the search for the distinguishing characters of a species or how it may be most easily distinguished from all similar species. The next step is to determine whether the distinguishing or diagnostic characters become modified in populations from one geographical area to another. This latter frequently involves considerable judgment and experience. If one

examines the literature one will often find a wide-ranging species has been described and named many times from a number of major geographical areas. It seems that many past authors have simply assumed that a species from one geographical area, let us say, Venezuela could not possibly be the same species as a similar-looking one from eastern Bolivia.

As an example of this sort of work, Bruner (1906) described and named a species from Sao Paulo, Brazil. The description is only a brief key with mention of the locality. Later that same year he described as new a species from Trinidad based on two females. He does say that this species is nearest to his species from Sao Paulo but gives no indication as to how they might differ. I sense that he really believed that his two species must be different and that it was simply a matter of someone else comparing the two species to find the differences. Incidently, both of Bruner's names prove to be junior synonyms of Serville's *Leptysma filiformis,* also described from Sao Paulo.

Another example of describing a species several times from different geographical localities is furnished by Rehn and Eades (1961) description of a "new species" from Vera Cruz, Mexico, and a new genus *Belosacris,* that included it along with two of Bruner's species from Paraguay and French Guiana. Although some 550 words describe the new genus and species, the only comparisons made with existing species is to state that, for the male type, "size somewhat smaller", and, for the allotype, "cerci are smaller", as compared to Bruner's species from Paraguay. As you might suspect, I can find nothing of any significance to distinguish the populations of this wide-ranging species. The Rehn and Eades proposal of a new species exemplifies two common faults of the past. The first fault lies in the assumption that species found distant from the known range of a species must belong to a different species. Bruner made the same error as Rehn and Eades in this regard when he described his species from French Guiana in 1911, and comparing it with his 1906 Paraguayan species he gave only slight size and color differences wich are of no significance. The second and more serious fault lies in the lack of information given on the characters that distinguish a species from other species of the genus. For some reason past authors seem to have believed that a careful, objective description of the type justifies and validates the proposal of the new species, and apparently assumes that students in the future can read such descriptions and recognize the species from all others. In my experience such descriptions are rarely of any use. For example, Rehn and Eades' description of the hind femur of their new species runs to 30 words though I suspect the description could apply equally well to every species in the tribe.

This comparison of populations from relatively distant geographical areas is complicated when minor differences such as color patterns become evident. I refer specifically to *Stenacris xanthochlora* (Marschall), generally known in the past as *S. cylindrodes* (Stal). This species ranges from Vera Cruz, Mexico, to northern Argentina. The male reproductive structures and other morphological characters that usually distinguish species of the genus are consistantly similar throughout the range of the species. On the other hand the presence or absence of a longitudinal, white body stripe, exhibits some geographical variation. Throughout most of the range of the species the white stripe is present in males and generally absent in females. One or two females in a large series of specimens from a locality will occasionally show the white stripe. From Surinam, French Guiana, and the eastern portion of northern Brazil all specimens of both sexes have the white stripe strongly developed. In Mexico and Central America the male has the white stripe, and it is usually lacking in the female though a series of eight males and eight females from Guanacaste, Costa Rica, lack the stripe in both sexes.

The presence or absence of the stripe does not appear to be related to any particular ecological or habitat condition, and I suspect that it is a genetically determined color morph. I have been unable to find any other character that can be correlated with the presence or absence of the stripe. It would seem to be more practical and useful to recognize the population as one wide-ranging species while giving recognition to this variation. Incidently, there have been seven junior synonyms proposed for this species, and Lawrence Bruner, not to be left out, proposed two of them.

In comparing populations of a species from different or distant geographical areas, I have referred to the situation in which no differentiation is evident, as with *Leptysma filiformis* and a species of *Belosacris,* treated by authors as two or more different species each. I have also just described the situation found in *Stenacris xanthochlora* in which there is some geographical variation in color pattern but not enough to warrant any formal recognition by name.

I will now discuss the situation where some significant geographic variation is evident.

In the genus *Cylindrotettix* I have found three species each with geographical differentiation in the male reproductive structures. The females cannot be distinguished. For example, I have specimens of *C. dubius* from 19 localities in southern Brazil, Paraguay, and Missiones in Argentina, all of wich have very similar reproductive structures. From four localities in eastern Peru and the Department of Santa Cruz in Bolivia I have a total of eight males, all of wich show a distinct modification of the aedeagus and also a slightly longer fastigium. In other respects there is little if anything to distinguish the populations from the two areas. The two other species mentioned show similar geographical differentiation. I have used the subspecific category to indicate their close similarity or relationship. They are allopatric in distribution, and to some degree they are probably reproductively isolated.

At a higher level of geographic differentiation I am also using the subspecific category to indicate the close relationship of four previously described species of *Stenacris.* These species have certain characteristics in common such as the shape of the ventral, relatively robust ovipositor valves and an unusually elaborate male subgenital plate. Conceivably they could even be considered a separate genus. The species are distinguished from each other by major differences in the male reproductive structures. They are all allopatric so far as known, and we can suspect that there is at least some degree of reproductive isolation. Retaining the four taxa within the genus *Stenacris* indicates that they are most nearly related to other members of the genus, and by treating them as subspecies of one species indicates their close relationship to each other as compared with other members of the genus, and suggests an allopatric distribution.

The recent scholarly study of the genus *Barytettix* by Cohn and Cantrall (1974) includes an example of the excellent use of the subspecific category. Looking at other groups of insects one can find surprising steps or stages in the process of speciation. I will refer briefly to the intensive studies on the *willistoni* group of *Drosophila* which occurs in the American tropics. A recent paper by Ayala et al. (1975) briefly describes the situation and gives references to many other papers on the subject. In the *willistoni* group of 15 species, 6 are sibling species (that is, nearly indistinguishable morphologically). All are reproductively isolated, and all are sympatric with each other in at least part of their range. Two of the sibling species have two subspecies each that are allopatric and only partly isolated reproductively in the laboratory (that is, F1 males are sterile). One of the other sibling species has 6 semispecies. A semispecies, so called, is similar to a subspecies in its degree of differentiation, but two or three of them may be sympatric with each

other at many localities. Though they hybridize in the laboratory thay apparently do not do so in the wild. I do not believe that a similar situation is likely to be found in grasshoppers, but it does remind us that the process of speciation can be complex. The intensive studies of this group of *Drosophila* was undertaken not to improve the classification of the group, but rather to investigate the process of speciation. I do believe that, with intensive studies of some of our wide-ranging species of grasshoppers, subtle differences may be found between different geographical populations, but such refinements are hardly needed at the present time.

Another difficult problem I encountered in treating the Leptysmini was the identification of types in order to find the valid name for a species. We are today fortunate in that most museum will readily loan holotypes to qualified workers. We can also be grateful to our collague, Dr. Carlos Carbonell, who traveled to Europe some few years ago and examined most of the 19th century acridid types. In many cases he found syntypes and selected a lectotype. He both photographed the types and made descriptive notes on them. He most generously provided me with needed information and photographs. With such help it was often unnecessary to examine the type.

Unfortunately, some types cannot be identified with certainty because the sex of the type does not have any known diagnostic characters. A case in point is the type of *Cylindrotettix obscurus* (Thunberg) 1827 labelled 'obscurus Amer. Merid' The type is a female, and it could very possibly be at least one other species. However, the name has long been applied to a common species, and it seems unlikely that there could be any good reason to question the identification, arbitary as it may be.

Another cause of trouble in nomenclature is the result of a pernicious disease that I call *nomenitis* (that is, a compulsion to name anything that might possibly represent a different species and let others worry about its validity). Lawrence Bruner, who proposed many new leptysmine names, was afflicted with this compulsion. Six or seven of his Leptysmini names were based on unique specimens, one of which is an injured and deformed specimen. It has not been possible, to date, to match specimens with two of his types, and though they probably represent valid species their relationship to other species will remain uncertain until at least the opposite sex is found.

An amusing example of Bruner's fear of losing an opportunity to name a species may be seen in his Biologia Centrali-Americana work of 1908 where he reports two females from Costa Rica and Honduras under the name of *Cylindrotettix insularis*, a species he had previously described from Trinidad. He made a few descriptive comments on these specimens and then remarked that perhaps these specimens were distinct, and for them he "suggested" the name *C.herbaceus*. I have been unable to distinguish these females from *C. insularis*, but males from Panama and northern Colombia prove to differ slyghtly from the Trinidad species. I have recognized these as a subspecies of *C. insularis* and have used Bruner's name, even though we cannot be certain of the identification of the type until males from Costa Rica are found. It is just such casual and useless work that causes confusion in nomenclature and is certainly quite unacceptable today.

I would comment briefly on the application of various levels of taxonomic catagories. There are presently seven recognized genera in the tribe *Leptysmini*. Two of these, *Cylindrotettix* and *Leptysmina*, which include 14 and 4 taxa, respectively, are distinct clusters of species and easily defined. The genus *Stenacris* includes 9 taxa and forms a moderately diverse cluster of species and have only a few unique characters that distinguishe them from other genera. The genus *Leptysma* includes a very diverse cluster of species, but they still seem more related to each other than to any of those of other genera. The remaining three genera include one to three species each. Two of these I have

considered placing in the genus *Stenacris*. The third genus is one of those names based on a unique male specimen and until females are found its affinity will be uncertain.

At first, I felt dissatisfied with the generic treatment of the tribe, especially upon looking for the reasons given by authors for erecting most of the genera. Then I realized that one could cluster the species into various generic arrangements depending on which set of characters was considered to be the more important. For example, one could emphasize the importance of the ovipositor valves, or the male reproductive structures, or the length and shape of the fastigium, or a combination of two or more of these and other sets of characters. This could result in a variety of generic classifications. Considering the genus *Cylindrotettix* a cohesive cluster of species and the genus *Leptysma* a diverse cluster of species, it became evident that to subdivide *Leptysma* to make it more comparable to *Cylindrotettix* would result in a series of genera containing one to three species in each. I finally concluded that the existing classification did not violate the relationships and therefore I decided to leave well enough alone, inconsistent as it might be.

Looking to the future I strongly recommended the following: comprehensive reviews or revisions of the various untreated groups of grasshopper be undertaken as soon as possible to establish a sound basis for the identification of species and the application of valid names. Such revision should consider all Neotropical species related to a group since some species range from Mexico to Argentina.

If a species clearly shows geographical differentiation the use of the subspecies category is urged in order to indicate close relationship and an allopatric distribution. If the significance or extent of the variation is at all doubtful it is preferable to treat it simply as a variable character of the species rather than naming the variation and possibly causing confusion or difficulty in future identifications.

The correct identification of holotypes is essential to a stable nomenclature. All holotypes bearing a valid name that might conceivably be related to the group being studied should be investigated. Unless a holotype has been examined by a specialist familiar with the diagnostic characters of the group, it should either be reexamined or critical information about it should be obtained to assure its identification. If the holotype cannot be identified with certainty because of its sex or other cause, then it is suggested that it be arbitrarily identified choosing the most likely species, providing it will not displace some long-established name. It is well to state the rationale for any such arbitrary identification in the hope that no one will be tempted to make a change in the future.

Finally, I would urge a rethinking of our conventional format of defining or describing a species. It would seem that the most important objective is to enable a person not familiar with the group to identify the species easily and accurately. A look at popular field guides on birds and other animals suggest that a good illustration, approximate geographical distribution, notes on the critical diagnostic characters, and mention of any other significant or peculiar features of the animal is the information most needed. I suggest that these four items be put in the forefront of any systematic treatment of a species. This information pertaining to the identification of the species can them be followed by information on the nomenclature, important bibliographic references, recording of specimens and related data, some comparative description, relationships, etc. The most important consideration should be to present the important diagnostic information where it can be easily seen and avoid cluttering the paper with lengthy descriptions of dubious value. There can be no set pattern or format for the treatment of species. So much depends on the state of our knowledge of the group. One

should bear in mind that illustrations, comparative tables of characters, and keys with ample references to figures are far more useful for identifying species than any written descriptions can be. I would like to see descriptions limited to comparative descriptions or descriptions of structures known to be diagnostic for related species. I recommend as an educational exercise taking a series of unidentified specimens from some tropical area where the fauna is not well known and of a group with which you are not familiar and attempt to identify them with the literature on the group at hand. I believe it would be immediately apparent how the format of the papers could have been improved to simplify the task of identification.

I have perhaps been overly critical of the authors mentioned due to the troubles they have caused me in the systematic treatment of the Leptysmini, but there is no doubt that these authors have made many substantial contributions to the systematics of the Orthoptera. I believe a little self criticism can help all of us, and I can only hope that I myself will not be responsible for too much confusion in the future.

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